

True lumen re-entry after extravascular recanalization of a superficial femoral artery chronic total occlusion

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A 66-year-old man was treated for disabling right leg calf claudication with angioplasty and stenting of a chronically occluded superficial femoral artery. During attempted subintimal passage, the guidewire tracked extralumenally, which was not recognized, but it was successfully redirected into the true lumen distal to the occlusion with the use of the Outback (Cordis Endovascular, Miami Lakes, Fla) re-entry device. A bare metal nitinol stent was initially deployed extralumenally in the perivascular soft tissue. The patient returned for reintervention 9 days later complaining of pain and discoloration of the popliteal space. Duplex evaluation of the superficial femoral artery revealed a pseudoaneurysm, and Viabahn stent grafts (W. L. Gore & Assoc, Flagstaff, Ariz) were successfully deployed to produce an endovascular percutaneous prosthetic bypass. (*J Vasc Surg* 2010;52:216-8.)

Chronic total occlusions of the superficial femoral artery (SFA) are often treated using endovascular techniques. The use of a re-entry device is sometimes needed when subintimal recanalization is used. We report a case of inadvertent true lumen re-entry from the extravascular space and describe the subsequent creation of a hemodynamically stable percutaneous prosthetic femoropopliteal bypass by way of stent graft deployment.

CASE REPORT

A 66-year-old man presented with disabling bilateral calf claudication, worse on the left, with severe pain on exertion at less than 1 block. His medical comorbidities included diabetes, carotid disease, and coronary artery disease. He had palpable femoral pulses but no palpable popliteal or pedal pulses. Noninvasive blood flow analysis revealed an ankle-brachial index (ABI) of 0.71 on the right, with blunted peripheral vascular resistance tracings. Evaluation with duplex ultrasound (DUS) imaging showed an occluded right SFA with reconstitution of the above-knee popliteal artery. An initial angiogram from the contralateral femoral approach showed an occluded right SFA (Fig 1).

After introduction of an up-and-over 6F sheath, uneventful subintimal recanalization of the right SFA was required using a guidewire and Glidewire (Terumo, Somerset, NJ). A re-entry device (Outback LTD, Cordis Endovascular, Miami Lakes, Fla) was needed for prompt and easy re-entry into the

true lumen at the level of the popliteal artery (Fig 1). Selective injection at the site of re-entry confirmed the intraluminal position, and angioplasty was performed with a 4-mm balloon, followed by deployment of two self-expanding 6- × 150-mm bare-metal nitinol stents (Protégé, EV3, Plymouth, Minn) for persistent stenosis (Fig 2, A). A single-vessel anterior tibial artery runoff was preserved to baseline.

The patient was discharged home a few hours later and presented to the outpatient office 6 days later for follow-up. He was asymptomatic with palpable dorsalis pedis pulses bilaterally, improved functional status, and no claudication. DUS surveillance showed a patent SFA stent with no unusual findings.

He presented to the outpatient office again 2 days later with right thigh pain, swelling, and ecchymosis extending into the leg. He was ambulatory with no ischemic pain, but had a pulsatile mass in the popliteal fossa with an absent pedal pulse. Repeat DUS imaging showed no evidence of deep vein thrombosis but did show a pseudoaneurysm of the distal SFA at the distal end of the previously placed stent. Repeat angiography showed extravasation along the entire length of the stented SFA (Fig 2, B), with a large pseudoaneurysm in the popliteal fossa and a single-vessel anterior tibial runoff. This was suggestive of an extravascular soft tissue recanalization plane and re-entry into the above-knee popliteal artery true lumen.

The stented segments were relined with two 6- × 15-cm heparin-bonded Viabahn stent grafts (W. L. Gore & Assoc, Flagstaff, Ariz), resulting in a percutaneous femoropopliteal bypass (Fig 2, C). DUS imaging the next day showed the Viabahn stent graft bypass was patent, with no evidence of extravasation or pseudoaneurysm formation and a triphasic signal in the dorsalis pedis runoff.

The patient was discharged home. Follow-up at 6 months showed complete symptom resolution, no claudication, and an improved ABI to 1.04, with no evidence of restenosis or extravasation on surveillance DUS imaging. The patient was maintained on antiplatelet therapy with clopidogrel (Bristol-Myers Squibb, New York, NY).

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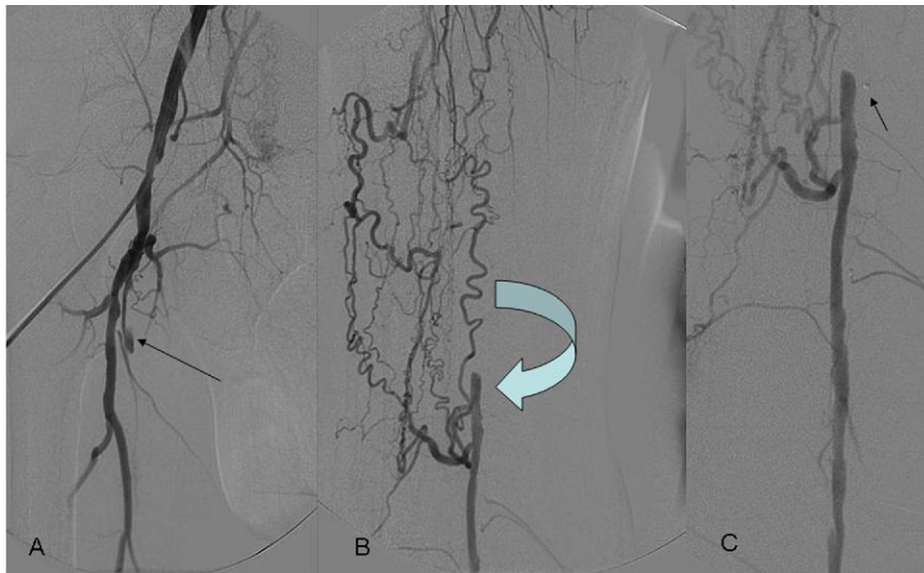


Fig 1. A, Near flush occlusion of the superficial femoral artery on the initial angiogram (*long arrow*). B, Reconstitution of the above-knee popliteal artery (*curved arrow*). C, Subintimal position of the re-entry device at the popliteal reconstitution (*short arrow*).

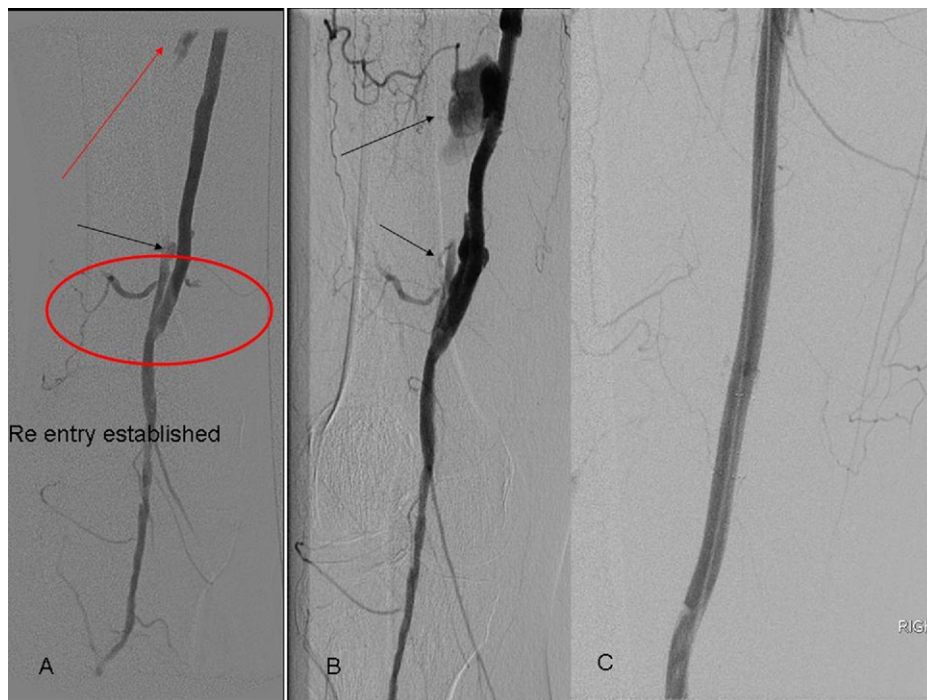


Fig 2. A, True lumen re-entry established (*circle*), followed by angioplasty and stenting, parallel to the native vessel course (*arrows*). B, Extravasation with pseudoaneurysm formation from the bare metal stent (*long arrow*). C, Percutaneous bypass established after deployment of covered stent.

DISCUSSION

As the rate of endovascular procedures for the treatment of SFA occlusion continues to rise, so has the variety of techniques and tools used for such procedures.¹ With the

significant number of technologic and procedural innovations of the past 2 decades, initial anatomic limitations for successful treatment no longer preclude endovascular repair as an option for treating more advanced cases of

peripheral arterial disease. This patient had a TransAtlantic Inter-Society Consensus (TASC) D lesion of the SFA, which was treated with reconstitution of the above-knee popliteal artery and with what initially appeared as a subintimal recanalization and true lumen re-entry, followed by angioplasty and stent placement.

Although revascularization of chronic total occlusions can often be achieved by simple guidewire recanalization, several devices are currently available to guide centerline crossing or re-entry from the subintimal plane. Blunt microdissection devices allow more active approaches to intraluminal lesion crossing. However, these devices have the potential to track subintimally and may require the use of a re-entry device to regain access to the true lumen.² Despite these advances in intraluminal crossing, guidewire techniques and subintimal passage remain most common for crossing chronic total occlusions.

Since the original description of this technique by Bolia et al³ enumerated the benefits of exploiting the subintimal plane, numerous methods and tools for therapy through this dissected portion of the vessel wall have become commonplace in endovascular treatment of occlusive disease.⁴⁻⁶ Once the lesion has been traversed in the subintimal plane, the operator typically re-enters the true lumen with a looped guidewire naturally at the nearest site of minimal atherosclerotic disease, or the operator can attempt to direct the wire tip to re-enter the true lumen of the vessel. Once the guidewire has re-entered the true lumen, the intervention is completed by expanding the subintimal space with balloon angioplasty and stent placement, if indicated. Failure of subintimal recanalization is usually secondary to the inability to regain access to the true lumen, and use of a re-entry device has been shown to improve success rates from about 85% to almost 100%.² In the situation of failed true lumen re-entry with guidewire techniques alone, a re-entry device can be used.

The two most commonly used re-entry devices are the Outback Ltd Catheter System and the Pioneer catheter (Medtronic Inc, Minneapolis, Minn). The Outback catheter is a 6F system that uses simple orthogonally oriented radiopaque markings to enable the operator to direct a re-entry needle toward the true lumen under fluoroscopic guidance with multiple views from the anteroposterior and several oblique angles. The Pioneer catheter, a 7F system, uses an integrated 64-element, phased-array intravascular ultrasound head to direct the re-entry needle toward the true lumen of the vessel. These devices may allow entry into extravascular planes or re-entry into a true lumen, even when the dissection plane is extravascular. Delivery of the bulky catheter to the area of interest in severely calcified vessels can be challenging, however, and severe calcifications may also prevent the needle from puncturing the plaque, even when ultrasound-guided, and can lead to device failure.

In this case, attempt at subintimal plane recanalization induced a complete perforation of the SFA. Although initially unrecognized, the use of the Outback catheter system allowed successful true lumen re-entry.

Multiple oblique imaging before deployment of the Outback needle is essential and was proven instrumental in true lumen re-entry in this case. In retrospect, the initial stent deployment showed exaggerated angles of guidewire re-entry inconsistent with standard presentations of re-entry from a subintimal plane. Such an angle is typically seen with bypass grafts at the distal anastomosis and should have provided a clue to the extravascular location of the dissection plane. Imaging from other oblique angles after deployment might have further elucidated this fact at the time of procedure. Although the perforation was immediately asymptomatic and tamponaded by the perivascular soft tissues, ongoing hemorrhage resulted in progressive local symptoms, with controlled hematoma formation. Use of a covered stent is therefore advocated if the re-entry angle or contrast extravasation are suggestive of an extraluminal plane.

Percutaneous lower extremity bypass has been previously described in a high-risk patient through the femoral vein by using US-guided entry into the vein from the superficial femoral artery and re-entry into the popliteal artery.⁵ Although this technique and the current approach are not advocated because they may not result in reproducible outcomes, intra-arterial re-entry is possible from a transvenous or extravascular soft tissue plane parallel to the SFA, therefore eventually resulting in a percutaneous prosthetic femoropopliteal bypass with stent graft deployment. The patency rate of SFA covered stents is comparable to that of prosthetic above-knee popliteal bypasses at 1 year.⁶ Albeit hemodynamically different, percutaneous bypasses may be as durable and could represent a revascularization option for high-risk patients.

Although we recognize this approach lacks reproducibility and has the potential for hemorrhage requiring emergency surgical exploration, it can be used as a bailout procedure with inadvertent extraluminal wire passage as well as in a planned fashion in select high-risk patients.

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